

DEPARTMENT OF THE ARMY
NEW ENGLAND DISTRICT, CORPS OF ENGINEERS
CONCORD, MASSACHUSETTS

WATER CONTROL MANAGEMENT
ANNUAL REPORT
FISCAL YEAR 2000

Prepared by:
Water Management Section
Reservoir Regulation Team

DECEMBER 2000

FOREWORD

This publication, prepared in accordance with OCE guidelines (ER 1110-2-240), summarizes the FY00 reservoir regulation activities of the New England District.

This report also describes important accomplishments of the Water Management personnel, reviews the status of the Water Control Data Collection System, and discusses future objectives for FY01.

Annual Reports have been prepared since 1972, and duplication of previous information has been kept to a minimum.

**NEW ENGLAND DISTRICT
FY00 ANNUAL REPORT
WATER CONTROL MANAGEMENT**

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NEW ENGLAND DISTRICT
FY00 ANNUAL REPORT
WATER CONTROL MANAGEMENT

A. GENERAL INFORMATION

1. **Purpose of Report.** This report outlines activities and accomplishments of the New England District (NAE), relating to reservoir regulation and water management throughout FY00. It is prepared in accordance with paragraph 13 of ER 1110-2-240, dated 8 October 1982, entitled Water Control Management.

2. **Organization for Water Control Management.** Water Control Management is the responsibility of the Reservoir Regulation Team of the Water Management Section, Water Resources Branch, Engineering-Planning Division, New England District. The office is located at Concord Park, 696 Virginia Road, Concord, Massachusetts.

New England District's Reservoir Regulation Team (RRT) is responsible for regulation activities at all Corps flood control reservoirs and hurricane barriers, collection of hydrologic and meteorologic data associated with regulation, coordination of information, and special studies. Specific responsibilities include the following:

- a. Directing regulation of New England District's reservoirs and hurricane barriers.
- b. Collecting, analyzing, and interpreting hydrologic and meteorologic data for real time water control/regulation purposes.
- c. Preparing and revising regulation plans and manuals for individual reservoirs, systems of reservoirs, and hurricane barriers.
- d. Developing products in WEB and GIS technology for data dissemination and public information purposes.
- e. Periodic meetings with field personnel to discuss regulation responsibilities and/or modifications.

During FY00, the Reservoir Regulation Team was understaffed due to a variety of personnel actions. Mr. Chris Scabia, from our Engineering Management Branch, accepted a 12-month detail to RRT in April 1999. His detail expired and Mr. Steven Simmer from our Hydrology & Hydraulics Coastal & Water Quality Team accepted a similar 12-month detail. Mr. Simmer joins the RRT staff with a strong background in hydrology & hydraulics and may be

permanently assigned to RRT at the end of his detail in September 2001. During FY00 Mr. Marinelli accepted a four month detail as Chief, Geotechnical and Water Management Branch. During this period Mr. David Schafer was temporarily promoted to Team Leader of RRT. Despite being understaffed, all Corps Dams and Hurricane Barriers were operated successfully during various runoff events, and numerous coastal storms. The current staff of the reservoir regulation team is as follows:

<u>Name</u>	<u>Position</u>	<u>Telephone No.</u>	<u>Yrs Exp.</u>
Paul Marinelli*--	Hydraulic Engineer	978-318-8630	28+
Greg Hanlon --	Hydraulic Engineer	-8632	13
David Schafer --	Hydraulic Engineer	-8163	12
Carmen Suarez --	Hydraulic Engineer	-8629	10
Steven Simmer --	Hydraulic Engineer	-8524	13

* Team Leader

The Hydrology & Hydraulics/Coastal and Water Quality Team are other elements of the Water Management Section available to provide technical assistance for special studies and reservoir regulation activities during flood periods. Technical assistance by RRT is also provided to this team. An organization chart of the Water Management Section is shown on Exhibit 1.

3. New England District Background. The New England District (NAE) has constructed 35 flood control dams, 5 hurricane barriers, and 100 local protection projects within New England. In addition, the District has acquired flowage rights on more than 8,000 acres of floodprone lands within the Charles River Natural Valley Storage area. A total of 31 of 35 reservoir projects, and 2 of 5 hurricane barriers are operated and maintained by the Corps, while the remaining projects are operated and maintained by local interests. NAE operates and maintains 10 of the 31 reservoirs for flood control only. Another 17 are operated primarily for flood control, and seasonally for recreational activities, under general authority of the Flood Control Act of 1944 (PL 78-534). The remaining four reservoirs are operated as multipurpose projects, including flood control, water supply, recreation, non-Federal hydropower, and fishery storage. A total of 28 of the 31 reservoirs, operated and maintained by NAE, are fully staffed with project personnel, while the remaining three are not staffed, have fixed opening outlet works, and do not require any daily or periodic regulation operation. NAE reservoirs are not operated for irrigation or navigation; however, non-Federal hydropower facilities have been installed at seven sites on Corps-owned lands, as described in paragraph B-11. The two Corps hurricane barriers at Stamford, CT, and New Bedford, MA, are operated for coastal storms and

hurricanes by closing navigation gates to prevent high ocean storm surges from entering their respective harbors.

B. WATER CONTROL MANAGEMENT DURING FISCAL YEAR 2000

1. **Flood Control** - During the fiscal year, the New England region experienced a diverse weather pattern. The dry conditions persisting in New England during FY99 were gradually replaced by wet conditions beginning with rainfall from tropical storm Floyd in September 1999 and continuing with near to slightly above normal rainfall during FY00. Most New England watersheds experienced near average monthly rainfall throughout the year with late spring and summer months experiencing greater than average amounts. The months of June and July were notably wet with total rainfall in some southern New England watersheds measuring up to two or three times average. Monthly precipitation totals for FY00 recorded at NAE dams are presented in Exhibit 2. Snowfall during the winter months started out below normal throughout the New England region and remained that way the entire season. By early March southern watersheds were already depleted of snow, and by late March northern watersheds were also depleted. Above normal rainfall occurred during March and April; however, with little to no snowpack available to contribute to runoff, there was no significant flooding. In fact, despite a relatively "wet" spring and summer, no significant flooding occurred throughout our watersheds during FY00. During the hurricane season (June through November), 14 named tropical storms/hurricanes formed in the Caribbean, Gulf of Mexico, and Atlantic Oceans, with none affecting New England. Several non-tropical storms also impacted the New England coastline during FY00 producing high winds and higher than normal tide levels.

a. **Regulation of Reservoirs** - During FY00 there were only minor occasions requiring reservoir regulation activities. Although some reservoirs experienced flood storage impoundments, the downstream runoff was not significant enough to cause river levels to approach or exceed flood stage, therefore, no "damages prevented" attributable to our dams or local protection projects were computed. Although the summer months were "wetter" than normal the timing of the rainstorms were such that the ground had the opportunity to "dry-up" between individual storms, thereby reducing the flood potential.

A summary of maximum reservoir levels and percent storage utilized during FY00 is shown on Exhibit 3. This exhibit also provides information on the two highest pool levels since completion of each project.

b. **Regulation of Hurricane Barriers** - During fiscal year 2000 the Stamford Hurricane barrier was operated on ten occasions

with total damages prevented of \$375,000. The New Bedford Hurricane barrier was operated on nine occasions with total damages prevented of \$305,000. The locally operated hurricane barriers in: Providence, Rhode Island (FoxPoint); New London, CT; and Pawcatuck (Stonington) CT, did not experience damaging tide levels and, therefore, no damages prevented were computed in FY00. None of the storms of FY00 produced tide levels of significant height to require further elaboration.

A summary of total number of operations by fiscal year for Stamford and New Bedford barriers is shown on Exhibit 4.

c. Summary of Flood Control Benefits

(1) FY00 Benefits - Flood control damages prevented from 1 October 1999 through 30 September 2000, including reservoirs, hurricane barriers and local protection projects totaled \$680,000, all of which were attributed to Corps hurricane barriers. Distributions of FY00 damages prevented by State are listed below.

<u>FY00 DAMAGES PREVENTED</u> (\$1,000)				
<u>State</u>	<u>Flood Control Reservoirs</u>	<u>Hurricane Barriers</u>	<u>Local Protection</u>	<u>Total</u>
Connecticut	0	\$375,000	0	375,000
Massachusetts	0	305,000	0	305,000
New Hampshire	0	N/A	0	0
Vermont	0	N/A	0	0
Rhode Island	0	0	0	0
Maine	<u>0</u>	<u>N/A</u>	<u>0</u>	<u>0</u>
TOTAL:	0	\$680,000	0	\$680,000

(2) Total Cumulative Flood Control Benefits - Flood control damages prevented for all projects cumulative through 30 September 2000 are summarized below. In addition, Exhibit 5 presents FY00 benefits, as well as cumulative benefits, for all

NAE owned and operated flood control storage projects (31 dams) and two hurricane barriers.

<u>Type of Project</u>	<u>Cumulative Benefits Thru 30 Sep 00</u>
Reservoirs	\$1,624,362,400
Local Protection	1,139,545,000
Hurricane Barriers	44,904,200
Total:	<u>\$2,808,811,600</u>

2. Drought/Low Flow Regulation - The dry conditions persisting in New England during FY99 were gradually replaced by wet conditions beginning with rainfall from tropical storm Floyd in September 1999 and continued with near to slightly above normal rainfall during FY00. Most New England watersheds experienced near average monthly rainfall throughout the year with late spring and summer months experiencing greater than average amounts. The months of June and July were notably wet with total rainfall in some southern New England watersheds measuring up to two or three times average. During FY00 there were no months experiencing precipitation deficits justifying drought contingency measures at any NAE reservoirs.

3. Water Supply - Three NAE reservoirs, Littleville Lake, Colebrook River Lake, and East Brimfield Lake have water supply storage allocated for municipal and industrial use. During FY00, only East Brimfield Lake made water supply releases for industrial processing in accordance with contractual obligations with the downstream American Optical, Inc. The American Optical Company of Southbridge, MA, owns 1,140 acre-feet of storage between pool stages of 9 and 13 feet at East Brimfield Lake. Small releases were requested and provided from this storage during the summer months.

4. Recreation - Throughout FY00, the following recreational releases were made from our reservoirs in support of downstream white water canoeing/kayaking.

a. Ball Mountain Lake. Releases of 1,500 cfs were provided for downstream recreational canoeing, kayaking and rafting, on the weekend of April 29-30, and weekend ending October 1.

b. Townshend Lake. Discharges from Ball Mountain Lake were released through Townshend Lake, on the same weekends as Ball Mountain Lake.

c. Otter Brook Lake. Releases of approximately 250 cfs were provided for downstream canoeing on the weekends of March 18-19, and April 15-16.

d. Birch Hill Dam and Tully Lake. Releases of 1,500 cfs at Birch Hill Dam and 400 cfs at Tully Lake were provided by temporarily raising the pool levels at both projects. This operation was required to maintain a river stage of approximately +1.0 foot at the Main Street bridge in Athol, MA. On the weekend of April 1-2 and for the 36th Annual River Rat Race on April 8-9.

e. Knightville Dam and Littleville Lake. Releases of 1,000 cfs at Knightville Dam and 700 cfs at Littleville Lake were provided by temporarily raising the pool levels at both projects for the 46th Annual Westfield River Wildwater Race, on the weekend of April 15-16.

f. Blackwater Dam. Releases of 600 cfs were provided for whitewater recreation by temporarily raising the pool level for the Blackwater Slalom Race on April 28-30.

g. East Brimfield Lake. On April 30 a release of 350 cfs was made by temporarily raising the pool level at East Brimfield Lake for the Sturbridge Lions Club All American River Race.

h. Mansfield Hollow Lake. Releases of 900 to 1200 cfs were provided by temporarily raising the pool level at Mansfield Hollow Lake for the Shetucket River Days Canoe Cruise event on June 18.

5. Initial Filling - There are no District reservoir projects presently under construction, or in the initial filling phase. During FY00 the largest storage impoundment occurred at the Colebrook River Lake project located on the West Branch Farmington River in Connecticut, a tributary of the Connecticut River. During a June 12th rainstorm event, the project utilized 27 percent of its total flood control storage capacity as a result of 7.5 inches of rain over a 12-day period. There were no related dam safety problems observed during this impoundment.

6. Project Regulation Constraints

a. General - Only West Hill Dam experienced some regulation constraints during FY00. Other than some minor downstream channel encroachments by abutting property owners, no major constraints occurred during FY00 that inhibited normal regulation procedures at our reservoirs. All major construction at Hodges Village Dam has been completed and no further reservoir restrictions are needed.

b. West Hill Dam - During the March 1998 flood, seepage occurred at West Hill Dam at a pool stage of 13.5 feet (17 percent full). Four boils at the downstream toe of the dam

embankment indicated that serious conditions could occur at higher pool levels. As a result, until a detailed geotechnical study can be performed and remedial measures identified and constructed, the project will be regulated to keep the pool level below 15 feet during minor to moderate floods, if possible. When the pool level approaches or exceeds 12 feet, geotechnical engineering personnel will be dispatched to the dam to perform visual inspections. A study, with drilling explorations, was completed in early FY99 and a follow-up Dam Safety Assurance Report was also completed recommending a concrete cutoff wall be installed similar to the construction just completed at Hodges Village Dam. Plans and Specifications phase of the design has been completed in FY00 with advertisement and construction award anticipated in FY01. During FY00, the maximum pool level experienced at West Hill Dam was only 8.8 feet, occurring in April 2000.

7. Deviations from Water Control Plans - During FY00 West Hill Dam continued with reservoir level restrictions due to on-going seepage problems. All reservoir regulations have been lifted at Hodges Village during FY00 as construction is complete. West Hill Dam restrictions will remain in affect for at least one to two more years depending on recommended construction programming. No additional major deviations were requested for New England District's reservoirs in FY00. Only minor, informal deviations occurred in support of downstream construction efforts. These minor deviations were for only a few hours on occasions throughout the fiscal year.

8. Status of Regulation Manuals - Work continues on revision of the January 1979 manual for Barre Falls Dam on the Ware River, Massachusetts, and Conant Brook Dam on Conant Brook, Massachusetts. The Barre Falls and Conant Brook Dam Manual is about 80 percent complete. The May 1974 manual for Birch Hill Dam and Tully Lake in the Millers River watershed was completed and approved in FY00. Exhibit 6 shows the five-year plan and current status of NAE's reservoir regulation manuals.

9. Data Collection

a. Data Collection Platforms (DCP)

(1) New Installations - During FY00 there were no new DCPs installed within NAE watersheds. NAE currently owns and operates 91 Data Collection Platforms (DCPs), 45 at river index stations, 43 at NAE dams, including tailwater gages, 2 at NAE hurricane barriers (although the New Bedford barrier DCP is not yet installed), and 1 test site at NAE Concord headquarters. During FY00 efforts continued to upgrade some of these platforms from single communication to dual communication where possible.

A breakdown of the number of DCPs by river basin is presented below:

<u>River Basin</u>	<u>No. DCPs</u>
Connecticut	38
Merrimack	22
Thames	12
Naugatuck	13
Blackstone	3
Hurricane Barriers	2
Test Site at NAE HQ	<u>1</u>
Total:	91

(2) Upgrades - During FY00 RRT continued to upgrade selected sites to Sutron 8210 units, having dual communication capabilities of GOES and Voice/Data. These 8210 units replaced existing Sutron 8200 and 8200A units. At the end of FY00 a total of 57 sites have dual communication units, representing about 63% of NAE's total data collection platform system. This completes all upgrades where telephone lines are available.

(3) Radio Transmitter Installations - RRT tested line of sight, SDI-12 radio transmitters manufactured by Design Analysis, to reduce the number of DCPs in the field. Radios were installed at both the North Hartland Lake gate tower and at the tailwater gage. The tailwater data is transmitted by radio to the gate tower DCP, where it transmitted over GOES with the pool stage data. This "one source" of data reduces the cost and maintenance of the system by eliminating the independent tailwater DCP.

(4) DCP Transmission Mode - NAE currently transmits data in both self-time (channel 31) and random (channel 129) modes from all data collection platforms. At the 45 river index station DCPs, data transmits hourly when critical river stage levels are reached.

(5) Maintenance - The Reservoir Regulation Team has renewed its contract for FY01 with the U.S. Geological Survey (USGS) for maintenance and recalibration of NAE's DCPs during their routine visits to stream gaging stations. The USGS has provided this service through their district offices in Massachusetts, Connecticut, New Hampshire, Vermont, and Rhode Island. The service significantly improves data accuracy and reduces the number of emergency site visits required by reservoir regulation personnel. During FY00, as agreed to in previous years, the USGS waived their routine visitation fee for sites

where they use NAE-owned data collection equipment to obtain their primary records (DCPs serve as data transmitters as well as data loggers).

b. Other Data Collection

(1) GOES Satellite - NAE has been using GOES-08, launched in April 1994, also known as GOES East, with advanced weather imagery, as its data collection satellite. NAE has an independent direct GOES downlink which receives data streams from our DCP network. This downlink serves as a backup to our primary data receive DOMSAT system.

(2) Domestic Communications Satellite (DOMSAT) - Reservoir Regulation Team uses DOMSAT as its data source for its primary DSS database system. The DOMSAT receive system has performed well during FY00. NAE presently has a link to Philadelphia District's DOMSAT system as a backup source to access NAE DCP transmissions.

(3) Emergency Managers Weather Information Network - During FY98 NAE purchased the Emergency Managers Weather Information Network (EMWIN). This system developed by the National Weather Service, in partnership with FEMA, provides access to a set of NWS warnings, watches, forecasts, imagery, and other products at no recurring cost. NAE's system uses the GOES satellite that distributes real-time text and graphical weather data to a ground receive antenna at the District. The system does not use either telephone lines or Internet connections, which are sometimes unreliable. EMWIN complements the 24-hour Weather Channel, available on RRT's cable TV system.

(4) Data Feed From National Weather Service - During FY00 the Reservoir Regulation Team implemented an automated data feed from the National Weather Service, Northeast River Forecast Center in Taunton, MA. Using an FTP process, current river stage forecasts are transferred to NAE's Water Control Data System, then written to the DSS database. This process can accommodate other data such as rainfall.

(5) Collection of Snow Survey Data Via the Web - During FY00 the Reservoir Regulation Team modified their web page to allow field personnel to input snow survey data via the web. The data is processed using a common gateway interface and arcview GIS software. Snow data is displayed in tabular and graphical format at the following Web address:

<http://www.nae.usace.army.mil/waterres/htdocs/htmlfiles/snowpage.html>.

(6) Data Sharing With Other Agencies - Since 1985

hydrologic data collected by RRT has been available via telephone modem, to agencies and organizations requiring this information. Since the development of the World Wide Web all real time hydrologic data is made available on our web page.

10. Water Control Data System (WCDS) - The Water Control Data System is implemented on the New England District LAN and presently includes the following equipment: two UNIX Sun workstations (one Sun Ultra60 and one Sun Ultra), one Integral Systems DOMSAT Receive Station, and five Dell Pentium II PCs running Hummingbird Exceed software. Other networked equipment includes two HP Color LaserJet printers, a Microtek desktop scanner with a Dell Pentium III PC, and an EMWIN system for real time weather images and NWS bulletins. Significant FY00 activities regarding the WCDS are as follows:

a. Sparc20 to Ultra60 Upgrade - RRT upgraded NAE's primary water control workstation from a Sun Sparc20 running Solaris 2.5.1 to a Sun Ultra60 with 36 gigabytes of hard disk storage, 1.2 gigabytes of RAM, a 360 megahertz processor and an Exabyte Mammoth tape drive capable of backing up the entire system on a single tape. The new machine runs the Solaris 7 operating system. During this upgrade RRT also installed Hummingbird Exceed software on five RRT PC's eliminating the need for the X-terminals previously used to connect to the WCDS.

b. RRT's Worldwide Web Home Page - During FY00 RRT continued updating and revising the existing home page. Data presented includes real-time hydrologic plots and tables, REPGEN summaries, historic pool stage, outflow, and frequency data, RRT administrative information, and links to other web sites frequently used in reservoir regulation activities. The site is image map driven and is available to the public through the NAE home page at the following URL address:

<http://www.nae.usace.army.mil/waterres/htdocs/index.html>.

All Project Managers at Corps Dams have access to our site and use the data frequently. There are currently interactive links between Project web pages and RRT's web page.

c. Sun Operating System (Solaris) - NAE's backup Sun workstation the Ultra60 is running Solaris 2.5.1, with all current patches installed. Our primary workstation was upgraded in FY00 to Solaris 7.

d. ESRI Arcview - RRT upgraded the ESRI Arcview software to version 3.2 and added the Spatial Analyst extension. RRT also developed procedures using arcview to process snow survey data and present the data in graphical reports via the web. NAE's water control GIS system, Corpview, was improved by

adding a "color-coded" network map of NAE's river gages representing flow conditions above or below flood levels, thereby making it a more valuable tool for real-time water control.

11. Federal Energy Regulatory Commission (FERC) - The Reservoir Regulation Team reviews and comments on all FERC inquiries concerning preliminary permits, exemptions, and license applications for hydropower activities at both Federal and non-Federal projects. This review is undertaken to ensure that hydropower projects have no significant impact on New England District's flood control activities. During FY00 there were no formal inquiries to this office. The status of non-Federal hydropower developments through September 2000 at NAE Corps sites is briefly summarized on Exhibit 7. It is noted that although the non-Federal hydropower plant at North Hartland Lake is listed as operational, it has been dormant for the past four years due to the owners, Vermont Electrical Cooperative, filing bankruptcy in FY96.

12. Training Personnel

a. Field Personnel - During FY00 RRT personnel visited projects within each basin to train field personnel on the use of various features of Sutron DCPs, access to data via PC connections, and use of NAE's Web page. Reservoir regulation discussions were held periodically throughout the year.

b. RRT Personnel - On-the-job training continued during FY00; outside training for RRT personnel included:

(1) Attended various Sun sponsored training sessions pertaining to the Solaris operating system.

(2) Attended Prospect courses at HEC and CRREL regarding GIS applications.

c. Other - Although not considered formal training, most RRT personnel gave formal presentations to local colleges, and visiting guests outside of NAE, on Water Management activities within New England. This participation is a very effective exercise in reinforcing our mission and sharpening our communication skills.

13. Funding - The Reservoir Regulation Team obtains funds from several sources for its varied activities. The annual Operation and Maintenance budget includes salaries for personnel involved in reservoir control operations, costs for USGS Cooperative Stream Gaging Program and DCP Maintenance Program, and monies for leasing, purchasing, and amortizing equipment used in water management activities. General Investigations provide limited funding for review of FERC inquiries and planning

studies. Funds are also obtained from the Plant Replacement and Improvement Program for purchases of major items such as computer workstations.

14. Cooperative Hydrologic Program - The FY00 Cooperative Stream Gaging Program with the New England Districts of the U.S. Geological Survey was a success. Under contract to the Corps of Engineers, the U.S. Geological Survey maintains and calibrates discharge-stage relationships, as well as tide levels, for a total of 72 gages throughout New England. In addition, the existing equipment at each gaging station is maintained by the USGS to insure accurate flow measurements. Coordination has been accomplished with New England District Chiefs of the U.S. Geological Survey for the FY01 Cooperative Stream Gaging Program, which has been reduced to 66 gages.

15. Data Collection Platform(DCP) Maintenance Program - The FY00 DCP Maintenance Program with the New England Districts of the U.S. Geological Survey was a success. The New England District pays the USGS for service and calibration of 89 existing data collection platforms in NAE's water control data system. The required service includes testing, calibrating, and making routine adjustments to the DCPs while on normal gage visits at approximately 6-week intervals and on-call servicing of DCPs that are inoperative or improperly functioning. On-call service is generally provided within 24-hours during high water periods and within 3 working days at other times. The FY01 program has been fully coordinated and finalized.

16. Support to NAD Water Control Mission - During FY00, NAE forwarded \$60,000 to NAD in support of MSC Water Control Management Activities. In FY01, the cost to NAE for this activity will increase slightly.

17. Federal and Non-Federal Partners - In FY99 NAE entered into a Partnering Agreement with the Vermont Agency of Natural Resources (ANR). In this agreement, NAE agrees to regulate our five flood control dams in the State of Vermont in the interest of protecting and preserving Vermont's natural resources by fully complying with State and Federal environmental laws. Ongoing discussions with the state of Vermont regarding modifications to our normal regulation procedures have continued into FY00. During FY00 NAE submitted a revised "flow-ramping" procedure for the Ball Mountain and Townshend Lakes Project and are awaiting comments from Vermont ANR.

C. FUTURE OBJECTIVES (FY01)

1. Water Control Data System - Continuation in the development of the WCDS will comprise a significant portion of the WCDS activities during FY01. Specific activities planned

include:

a. Expand our current real time data feed from the National Weather Service, Northeast River Forecast Center. New data that is being considered is precipitation, which will greatly improve the accuracy of NAE's rainfall data network.

b. Further develop GIS applications and products for water control. Currently, inundation mapping is being developed along the Connecticut River displaying inundated areas at various river levels above flood stage.

c. Continue to participate in the modernization monthly conference calls and begin to plan towards the purchase of Oracle software as the first step in implementing the new Corps Water Management System (CWMS).

2. GOES Data Collection System

a. Testing is planned for the "Nimbus," a compact, tankless SDI-12 bubbler manufactured by Ott Hydrometry. This system can replace the pressure transducer, coniflow, nitrogen tank system used at many of NAE's data collection sites. The Nimbus is not only less expensive than current equipment, but requires far less maintenance, eliminating the need for replacing the nitrogen tanks.

b. Explore further cooperative programs for combining data collection efforts with the local National Weather Service and the New Hampshire Department of Water Resources.

c. Explore reducing the number of DCPs in the field using Design Analysis radio transmitters to consolidate DCPs that are nearby one another, similar to the installation at North Hartland Lake. This will reduce maintenance and system costs while providing a central, "one source", data collection platform.

d. Replace NAE's existing direct receive ground station hardware including: the down converter, LNA, multiplexer, demodulators, and receiver with either a modern digital direct receive ground station or a NOAA Port system.

3. Training - The following training courses are scheduled to be attended by RRT personnel.

a. PROSPECT: Intermediate GIS Applications at CRREL, NH.

b. OTHER: Attend seminars, Sun computer courses, etc. as they become available.

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Reservoir Management

Reservoir Regulation
Reservoir Manuals
Hydrologic Equipment
Coordination

Data Collection

Coordinate with USGS, NWS
GOES Reporting
Data Analysis
DOMSAT System
Water Control Data System

Special Studies

Real-Time Hydrologic
Modeling
Real-Time River Forecasting
Review of FERC Licences
Special Reservoir Studies
RCC Home Page
Development

Planning

River Basin and Reservoir System Studies
Urban Stormwater Modeling Studies
Coastal and Riverine Flood Control Investigations
Coastal and Riverine Erosion Studies
Navigation Studies - Currents
Environmental Restoration Studies
Hydropower & Water Supply Investigations

Design

Multi-Purpose Reservoirs, Water Control Structures
Channels, Conduits, Dikes and Walls
Coastal and Riverine Local Protection Projects
Hurricane Barriers and Tidal Flood Gates
Coastal and Riverine Erosion Projects
Navigation Improvement Projects - Currents
HTRW/Superfund Projects

Water Quality Management

Water Quality Data Collection
Coastal, Lake and Stream Studies
Mathematical Modeling
Groundwater Quality Analysis
Beaches and Potable Water

Informational Studies

Coastal and Riverine Flood Plain Management
Coastal and Hyd Engr for Flood Insurance Program
River Basin Models
Periodic Dam Inspections & Reports
Dam Break Flood Analysis
Tidal/Wetland/Environmental Restoration
Hurricane Evacuation Planning
ERGO Assessments

MONTHLY PRECIPITATION IN INCHES AT NAE LAKES & DAMS - FY 2000

<u>PROJECT NAME</u>	<u>-OCT-</u>	<u>-NOV-</u>	<u>-DEC-</u>	<u>-JAN-</u>	<u>-FEB-</u>	<u>-MAR-</u>	<u>-APR-</u>	<u>-MAY-</u>	<u>-JUN-</u>	<u>-JUL-</u>	<u>-AUG-</u>	<u>-SEP-</u>	<u>TOTAL</u>	<u>% AVG</u>
UNION VILLAGE DAM	3.10	2.32	1.27	3.89	2.88	2.77	5.29	4.83	2.82	3.31	4.21	1.96	38.65	113%
NORTH HARTLAND LAKE	3.21	2.62	1.06	3.48	2.60	2.59	4.64	3.24	3.35	3.98	3.13	1.87	35.77	104%
NORTH SPRINGFIELD LAKE	3.20	3.40	1.38	3.75	3.20	2.85	4.50	2.99	3.39	5.41	3.67	1.88	39.62	107%
BALL MOUNTAIN LAKE	2.64	3.74	1.88	4.52	3.92	4.81	5.09	3.25	5.55	7.34	6.12	2.16	51.02	106%
TOWNSEND LAKE	4.10	4.03	1.89	4.11	3.43	4.72	4.75	3.47	4.86	5.88	5.19	2.67	49.10	116%
SURRY MTN LAKE	3.84	2.18	1.78	3.02	3.22	2.82	4.57	4.30	4.24	4.45	3.93	4.16	42.51	109%
OTTER BROOK LAKE	4.23	3.04	1.70	3.32	3.53	3.31	5.95	4.70	4.85	5.30	5.08	3.58	48.59	119%
BIRCH HILL DAM	4.74	2.88	2.05	3.89	3.78	3.80	5.84	3.54	7.06	4.13	5.85	4.47	52.03	122%
TULLY LAKE	3.48	2.75	1.53	3.51	3.32	4.17	5.71	3.57	5.80	4.81	6.45	3.07	48.17	110%
BARRE FALLS DAM	4.38	2.94	2.19	2.82	3.31	4.26	6.88	4.22	6.51	4.84	3.54	3.91	49.80	117%
KNIGHTVILLE DAM	4.59	3.60	2.33	3.61	3.11	4.25	4.77	3.41	8.36	6.44	4.83	3.12	52.42	114%
LITTLEVILLE LAKE	4.32	3.48	2.36	3.70	3.16	4.27	4.63	4.78	7.86	6.41	3.47	3.49	51.93	110%
COLEBROOK LAKE	5.45	3.64	2.75	4.33	3.13	4.78	3.39	6.05	9.07	8.36	2.61	3.69	57.25	104%
FRANKLIN FALLS DAM	3.28	2.12	1.94	3.49	3.95	3.74	5.31	3.15	3.34	4.29	2.47	3.72	40.80	101%
BLACKWATER DAM	3.58	1.80	1.73	3.42	3.39	3.98	6.09	3.03	4.91	3.12	3.15	2.51	40.71	96%
ED MACDOWELL LAKE	3.24	2.97	2.11	3.82	3.62	3.65	6.94	3.53	3.95	5.54	2.78	3.92	46.07	100%
HOPKINTON LAKE	3.64	2.02	1.87	3.74	4.04	3.63	6.14	4.50	4.18	5.94	2.69	3.06	45.45	106%
EVERETT LAKE	3.64	2.97	1.58	3.64	4.04	3.65	6.14	4.06	1.82	5.94	2.69	3.23	43.40	101%
EAST BRIMFIELD LAKE	3.83	3.81	2.61	3.34	2.83	4.24	6.12	3.52	5.60	5.39	3.20	3.29	47.78	106%
WESTVILLE LAKE	3.83	3.81	2.61	3.34	2.83	4.24	6.12	3.17	5.60	4.38	2.99	3.29	46.21	91%
WEST THOMPSON LAKE	4.74	2.43	2.93	4.44	2.82	4.48	6.23	3.52	5.87	4.03	2.20	3.23	46.92	96%
BUFFUMVILLE LAKE	4.30	2.52	2.62	3.70	3.01	3.79	7.03	3.34	5.25	4.06	1.46	3.68	44.76	97%
HODGES VILLAGE DAM	4.30	3.81	2.62	3.70	3.01	3.79	7.03	2.88	5.25	4.00	1.46	3.51	45.36	98%
MANSFIELD HOLLOW LAKE	5.45	3.12	3.18	4.24	2.74	4.86	6.30	6.37	4.85	3.97	2.35	4.11	51.54	109%
THOMASTON DAM	4.57	3.72	2.41	3.07	2.75	3.36	3.46	3.49	5.15	8.05	3.16	4.35	47.54	101%
BLACK ROCK LAKE	5.23	3.76	2.60	3.56	2.91	3.50	3.47	3.69	5.32	8.13	4.25	3.78	50.20	98%
HOP BROOK LAKE	4.13	3.32	2.51	1.80	3.98	3.18	3.86	2.90	4.88	7.56	3.93	3.05	45.10	90%
WEST HILL DAM	4.48	2.12	2.13	4.11	3.50	5.33	5.80	3.45	5.64	3.44	2.77	2.92	45.69	93%

SUMMARY OF MAXIMUM POOL LEVELS IN FEET

<u>Reservoir</u>	<u>Fiscal Year 2000</u>			<u>Highest of Record</u>			<u>Second Highest</u>			<u>Placed in Operation</u>
	<u>Pool Level</u> (FT)	<u>%Full</u>	<u>Date</u>	<u>Pool Level</u> (FT)	<u>%Full</u>	<u>Date</u>	<u>Pool Level</u> (FT)	<u>%Full</u>	<u>Date</u>	
Union Village Dam	52.9	6	Mar 00	114.2	53	Apr 69	103.8	40	Jun 84	1950
North Hartland Lake	68.7	21	Mar 00	135.8	71	Apr 87	128.2	63	Apr 69	1961
North Springfield Lake	40.8	16	Mar 00	85.2	82	Apr 87	78.8	69	Apr 69	1960
Ball Mountain Lake	115.9	17	Mar 00	213.9	100+	Apr 87	197.8	82	Apr 69	1961
Townshend Lake	53.8	25	Apr 00	98.6	100+	Apr 87	82.0	70	Feb 81	1961
Surry Mountain Lake	23.7	9	Apr 00	66.1	100+	Apr 87	61.4	89	Jun 84	1941
Otter Brook Lake	27.7	5	Feb 00	99.4	100+	Apr 87	88.7	82	Jun 84	1958
Birch Hill Dam	15.4	15	Apr 00	33.8	80	Apr 87	30.6	64	Jun 84	1941
Tully Lake	18.5	9	Apr 00	35.3	62	Apr 87	35.0	61	Jun 84	1949
Barre Falls Dam*	786.6	17	Apr 00	801.4	70	Apr 87	799.7	64	Jun 84	1958
Conant Brook Dam	N/A			27.0	16	Jun 84	24.5	13	Jun 8	1966
Knightville Dam	66.3	17	Jun 00	132.4	100+	Apr 87	130.2	100+	Jan 49	1941
Littleville Lake*	531.6	19	Jun 00	571.7	89	Apr 87	568.9	83	Jun 84	1965
Colebrook River Lake*	724.9	27	Jun 00	757.5	90	Jun 84	747.1	68	Apr 83	1969
Mad River Dam	43.6	5	Jun 00	74.6	25	Jun 84	74.4	25	Apr 87	1963
Sucker Brook Dam	N/A			25.2	24	Dec 73	24.9	24	Apr 87	1970
East Branch Dam	9.1	1	Jul 00	39.8	31	Apr 87	38.8	29	Jun 84	1964
Hall Meadow Brook Dam	12.7	6	Jun 00	23.5	24	Jun 84	21.6	19	Apr 87	1962
Thomaston Dam	34.8	5	Oct 99	87.2	50	Jun 84	75.6	34	Apr 87	1960
Northfield Brook Lake	27.7	3	Jun 00	67.4	40	Jun 84	62(est)32		Apr 87	1965
Black Rock Lake	35.4	3	Jun 00	93.4	65	Jun 84	84.5	50	Jun 82	1970
Hancock Brook Lake	7.9	2	Jun 00	23.4	58	Jun 82	19(est)37		Apr 87	1966
Hop Brook Lake	23.5	2	Jul 00	57.7	53	Jun 82	55.4	47	Jun 84	1968
Franklin Falls Dam*	340.5	24	Apr 00	375.7	76	Mar 53	375.4	76	Apr 87	1943
Blackwater Dam*	541.2	8	Apr 00	564.1	90	Apr 87	561.6	74	Apr 69	1941
Edward MacDowell Lake*	918.2	11	Apr 00	949.8	100+	Apr 87	943.2	85	Jun 84	1950
Hopkinton Lake*	391.8	13	Apr 00	415.8	95	Apr 87	407.5	59	Jun 84	1962
Everett Lake*	352.4	3	Apr 00	415.8	95	Apr 87	405.5	59	Jun 84	1961
Buffumville Lake	18.6	16	Apr 00	32.5	58	Apr 87	28.4	43	Mar 68	1958
Hodges Village Dam	12.7	10	Apr 00	27.4	59	Apr 87	23.4	44	Mar 68	1959
East Brimfield Lake	18.6	12	Apr 00	26.1	47	Jun 84	26.0	47	Apr 87	1960
Westville Lake	21.0	5	Apr 00	50.5	56	Jun 84	49.2	48	Apr 87	1962
West Thompson Lake	22.4	11	Apr 00	40.9	60	Apr 87	38.9	53	Jun 84	1965
Mansfield Hollow Lake	29.4	16	Apr 00	52.6	66	Jun 82	51.8	65	Aug 55	1952
West Hill Dam	8.8	8	Apr 00	25.5	67	Apr 87	24.3	59	Mar 68	1961

* Elevation of pool in feet NGVD

SUMMARY OF NEW ENGLAND DISTRICT
HURRICANE BARRIER OPERATIONS

<u>Fiscal</u> <u>Year</u>	<u>Number of</u> <u>Stamford</u>	<u>Operations</u> <u>New Bedford</u>	<u>Fiscal</u> <u>Year</u>	<u>Number of</u> <u>Stamford</u>	<u>Operations</u> <u>New Bedford</u>
1966	--	4	1986	7	2
1967	--	3	1987	11	3
1968	6	3	1988	6	3
1969	8	1	1989	8	4
1970	9	5	1990	1	5
1971	14	12	1991	5	11
1972	36	18	1992	16	17
1973	13	9	1993	6	20
1974	16	5	1994	2	19
1975	9	6	1995	6	26
1976	7	6	1996	10	32
1977	16	10	1997	4	23
1978	13	5	1998	19	25
1979	17	14	1999	9	17
1980	13	8	2000	10	9
1981	6	2			
1982	4	4			
1983	12	7			
1984	15	4			
1985	10	6			

EXHIBIT 4

	(\$1,000)	
	FY00	CUMULATIVE INCLUDING FY00
DAMS AND RESERVOIRS		
UNION VILLAGE DAM	0	30,338
NORTH HARTLAND LAKE	0	80,463
NORTH SPRINGFIELD LAKE	0	84,437
BALL MOUNTAIN LAKE	0	97,023
TOWNSHEND LAKE	0	62,559
SURRY MOUNTAIN LAKE	0	60,869
OTTER BROOK LAKE	0	27,555
BIRCH HILL DAM	0	58,724
TULLY LAKE	0	21,764
BARRE FALLS DAM	0	23,321
CONANT BROOK DAM	0	2,296
KNIGHTVILLE DAM	0	143,462
LITTLEVILLE LAKE	0	54,124
COLEBROOK RIVER LAKE	0	37,156
MAD RIVER DAM *	0	2,709
SUCKER BROOK DAM *	0	145
EAST BRANCH DAM *	0	10,512
HALL MEADOW BROOK DAM *	0	9,596
THOMASTON DAM	0	242,362
NORTHFIELD BROOK LAKE	0	22,420
BLACK ROCK LAKE	0	65,060
HANCOCK BROOK LAKE	0	29,894
HOP BROOK LAKE	0	31,076
FRANKLIN FALLS DAM	0	69,135
BLACKWATER DAM	0	19,852
EDWARD MACDOWELL LAKE	0	7,846
HOPKINTON-EVERETT LAKES	0	63,301
BUFFUMVILLE LAKE	0	54,633
HODGES VILLAGE DAM	0	52,083
EAST BRIMFIELD LAKE	0	45,007
WESTVILLE LAKE	0	22,959
WEST THOMPSON LAKE	0	18,409
MANSFIELD HOLLOW LAKE	0	43,209
WEST HILL DAM	0	30,064
* Owned & Maintained by CT DEP		
DAMS AND RESERVOIRS TOTAL:	0	1,624,363
HURRICANE BARRIERS		
NEW BEDFORD HURRICANE BARRIER	305	17,211
STAMFORD HURRICANE BARRIER	375	25,039
HURRICANE BARRIERS TOTAL:	680	42,250
GRAND TOTAL:	680	1,666,613

**STATUS OF WATER CONTROL MANUALS
NEW ENGLAND DISTRICT
FY00 THRU FY05**

	<u>CURRENT DATE</u>	<u>SCHEDULED UPDATE</u>	<u>APPROVED</u>		<u>CURRENT DATE</u>	<u>SCHEDULED UPDATE</u>	<u>APPROVED</u>
CONNECTICUT RIVER BASIN				THAMES RIVER BASIN			
Master Manual *	Jan 84	FY03		Master Manual *	Jul 80	FY03	
Union Village Dam	Apr 94	--		Mansfield Hollow Lake *	Jul 80	FY03	
North Hartland Lake	Dec 85	FY03		Buffumville Lake *	Jul 80	FY03	
North Springfield Lake	Oct 68	FY99	Sep-99	Hodges Village Dam *	Jul 80	FY03	
Ball Mountain Lake	Sep 73	FY02		East Brimfield Lake *	Jul 80	FY03	
Townshend Lake	Sep 73	FY02		Westville Lake *	Jul 80	FY03	
Surry Mountain Lake	Jan 72	FY02		West Thompson Lake *	Jul 80	FY03	
Otter Brook Lake	Jan 72	FY02					
Birch Hill Dam	May 74	FY99	Sep-00	BLACKSTONE RIVER BASIN			
Tully Lake	May 74	FY99	Sep-00				
Barre Falls Dam	Feb 79	FY01		Master Manual *	Jul 80	FY02	
Conant Brook Dam	Feb 79	FY01		West Hill Dam *	Jul 80	FY02	
Knightville Dam	Jan 78	FY01					
Litleville Lake	Jan 78	FY01		HOUSATONIC RIVER BASIN			
Colebrook River Lake	Mar 90	FY03					
Mad River Dam	Mar 90	FY03		Master Manual *	Oct 76	FY02	
Sucker Brook Dam	Mar 90	FY03		Hall Meadow Brook Dam *	Oct 76	FY02	
				East Branch Dam *	Oct 76	FY02	
MERRIMACK RIVER BASIN				Thomaston Dam*	Oct 76	FY02	
Master Manual	Aug 77	FY00	Sep-99	Black Rock Lake *	Oct 76	FY02	
Franklin Falls Dam	Aug 77	FY00	Sep-99	Northfield Brook Lake *	Oct 76	FY02	
Blackwater Dam	Aug 77	FY00	Sep-99	Hancock Brook Lake *	Oct 76	FY02	
Edward MacDowell Dam	Aug 77	FY00	Sep-99	Hop Brook Lake *	Oct 76	FY02	
Hopkinton-Everett Lakes	Aug 77	FY00	Sep-99				
				HURRICANE BARRIERS			
				New Bedford-Fairhaven	Aug 83	FY03	
				Stamford	Sep 98	FY98	Oct-98

* Expect to Contract to A-E Firm

NON-FEDERAL LICENSED HYDROPOWER PLANT INSTALLATIONS AT CORPS PROJECTS

FERC LIC NO.	CORPS FLOOD CONTROL PROJ	LICENSEE	DATE OF LICENSE	STATUS ⁽¹⁾
2816	N. HARTLAND LAKE ,VT	VT ELECT. COOP	11/24/81	0 ⁽²⁾
4117	COLEBROOK RIVER LAKE, CT	HARTFORD MDC	3/27/84	0
5313	N. HARTLAND, VT (DEWEY MILLS)	HYDRO-ENERGIES	1/20/83	0
5735	HOPKINTON LAKE, NH	TOWN OF HOPKINTON, NH	3/14/84	0
7410	EDW. MACDOWELL LAKE, NH (VERNEY MILLS)	AMERICAN HYDRO, INC.	8/18/84	0
7248	FRANKLIN FALLS DAM, NH	FRANKLIN FALLS HYDRO	4/16/83 ⁽³⁾	0
3107	FRANKLIN FALLS DAM, NH	NEWFOUND ELECT	11/16/81	0
9085	UNION VILLAGE DAM, VT	RICHARD BALAGUR	5/4/89	P

(1) O – Operational, P – Proposed

(2) Project inactive, licensee filed for bankruptcy in FY 96

(3) Date of FERC order issuing exemption from licensing

EXHIBIT 7